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CORRECTIVE MEASURES STUDY WORK PLAN MEMBRANE INTERFACE PROBE PHASE 2 PILOT STUDY SOLID WASTE MANAGEMENT UNIT 166 (SWMU 166) ZONE K CNC CHARLESTON SC

2/1/2001

CH2M HILL

CORRECTIVE MEASURES STUDY WORK PLAN

Membrane Interface Probe (MIP) Phase II Pilot Study

Solid Waste Management Unit 166, Zone K

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

CH2M-Jones

February 2001

Revision 1
Contract N62467-99-C-0960

D H E C
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708

February 22, 2001

Matthew Humphrey
Caretaker Site Office
NAVFACENGCOM, Southern Division
P. O. Box 190010
North Charleston, SC 29419-9010

Re: Corrective Measures Study (CMS) Work Plan for Phase II Membrane Interface Probe (MIP) Pilot Study for SWMU 166 located in Zone K Annex of the Charleston Naval Complex, SCO 170 022 560, Revision 1.0, dated February 2001, received February 5, 2001.

Dear Mr. Humphrey:

The South Carolina Department of Health and Environmental Control (Department) has reviewed the above referenced document according to applicable State and Federal Regulations, and the Charleston Naval Complex Hazardous Waste Permit, effective September 17, 1998. Based on this review and the attached comment responses, the Department has no additional comments at this time and the referenced document is approved. Further, the CNC should note that the Department's approval is based on the information provided to date. Any new information found to be contradictory may require further action.

Should you have any questions regarding this issue, please contact Mihir Mehta at (803) 896-4088 or Paul Bergstrand at (803) 896-4016.

Sincerely,

David Scaturo, PE, PG
Manager, Corrective Action Engineering Section
Division of Waste Management
Bureau of Land & Waste Management

Attachments:
1. Memorandum from Paul M. Bergstrand to Mihir Mehta dated February 21, 2001.

cc: Paul Bergstrand, Hydrogeology
Rick Richter, Trident EQC
Dean Williamson, CH2MHILL
Dann Spariosu, EPA Region IV
Rob Harrell, SOUTHDIV

D.H.E.C.
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708

MEMORANDUM

TO: Mihir Mehta, Environmental Engineer Associate
Corrective Action Engineering Section
Division of Waste Management
Bureau of Land and Waste Management

FROM: Paul M. Bergstrand, P.G., Hydrogeologist
RCRA Hydrogeology Section
Division of Hydrogeology
Bureau of Land and Waste Management

DATE: 21 February 2001

RE: Charleston Naval Base (CNAV)
Charleston County, South Carolina
SC0-170-022-560

Zone K, SWMU 166; Corrective Measures Study Work Plan
Membrane Interface Probe (MIP) Phase II Pilot Study
Dated February 2001, Received 5 February 2001

The materials referenced above have been reviewed with respect to the requirements of R.61-79 of the South Carolina Hazardous Waste Management Regulations, The Environmental Protection Agency's (EPA) RCRA Facility Investigation Guidance Document dated May 1989, the EPA Region IV Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual (SOP/QAM) dated May 1996, the CNAV Final Comprehensive Sampling and Analysis Plan dated 30 August 1994.

The proposed sample locations and methodology are suitable for this investigation. A monitoring well request has been submitted and approved. All comments have been suitably addressed and the document is approvable. Please note, additional site assessment may be required upon review of the results of this workplan.

CORRECTIVE MEASURES STUDY WORK PLAN

Membrane Interface Probe (MIP) Phase II Pilot Study

Solid Waste Management Unit 166, Zone K

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

PREPARED BY
CH2M-Jones

February 2001
158814.ZK.PR.07

Revision 1
Contract N62467-99-C-0960

Certification Page for Corrective Measures Study Work Plan – SWMU 166, Zone K

Membrane Interface Probe (MIP) Phase II Pilot Study

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

Temporary Permit No. T2000342

Dean Williamson, P.E.

2/1/2001

Date

SOUTH CAROLINA
CH2M
HILL, INC.
No. C00201
CERTIFICATE OF AUTHORIZATION

Contents

Acronyms and Abbreviations

°C	degrees Celsius
CMS	corrective measures study
CNC	Charleston Naval Complex
CSAP	Comprehensive Sampling and Analysis Plan
1,2-DCE	1,2-dichloroethene
DNAPL	dense non-aqueous phase liquid
DMP	Data Management Plan
DPT	direct-push technology
ECD	electron capture detector
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
eV	electron-volt
ft bls	feet below land surface
GC/MS	gas chromatograph/mass spectrometer
IDW	investigative-derived waste
µg/L	microgram per liter
µV	micro-volt
mg/L	milligrams per liter
MIP	membrane interface probe
msl	mean sea level
mS/m	microsiemens per meter
MW	monitoring well

Acronyms and Abbreviations

ORP	oxidation/reduction potential
PID	photoionization detector
QAP	Quality Assurance Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SCDHEC	South Carolina Department of Health and Environmental Control
SWMU	solid waste management unit
TCE	trichloroethene
VOC	volatile organic compound

SECTION 1.0

Introduction

1.0 Introduction

1.1 Purpose of MIP Investigation

This corrective measures study (CMS) work plan presents a technical approach for using the membrane interface probe (MIP) instrument to characterize the magnitude and extent of a trichloroethene (TCE) dense non-aqueous phase liquid (DNAPL) source area at solid waste management unit (SWMU) 166, at the Charleston Naval Complex (CNC) Annex. The source area delineation information obtained from these activities will be used to identify the target treatment areas to be addressed using the six-phase heating process.

The Phase I pilot study completed September 13, 2000, in the area of the existing Monitoring Well (MW) 166GW025D demonstrated the MIP as an effective site characterization technology. The technical approach for the Phase I pilot study was documented in the *CMS Work Plan, MIP Pilot Study Phase I*, dated July 21, 2000, and prepared by CH2M-Jones. The Phase I work plan was approved on August 17, 2000, by the South Carolina Department of Health and Environmental Control (SCDHEC). The results of the Phase I pilot study with a summary of the field activities are provided as Appendix A.

1.2 Site Background and Setting

The CNC Annex is located north/northwest of CNC and is bound to the north by Airport Road, to the east by Interstate 26, to the south by Air Park Road, and to the west by the Charleston Air Force Base. The Naval Annex is a flat-lying area, approximately 40 feet above mean sea level (msl). The U.S. Marine Corps currently uses the Naval Annex as a reserve training center, which houses administrative and classroom type buildings and a heavy vehicle storage and maintenance/small repair facility.

Previous investigations at SWMU 166 identified concentrations of TCE at or greater than 1 percent of the maximum solubility in water at several locations at SWMU 166; the maximum solubility of TCE in water is approximately 1,100 milligrams per liter (mg/L). Concentrations of this level are often a likely indicator of the presence of a DNAPL source area near the monitored location. The potential DNAPL source area is expected to include the area at the top of the Ashley Formation (approximately 31 to 37 feet below land surface [ft bls]) and at the interface between the clayey sand unit and overlying sandy unit

(approximately 23 to 28 ft bls), and also may occur at other depths. Figures 1-1 and 1-2 represent a summation of the detected concentrations of volatile organic compounds (VOCs) in the shallow (less than 20 ft bls) and deep (20 to 36 ft bls) intervals of the saturated zone at each sample collection location. The maximum summation concentration is represented for each location where two or more samples were collected, such as the Geoprobe and vertical profiler locations.

1.3 Organization of CMS Work Plan

This CMS work plan consists of the following six sections, including this introductory section and appendices.

1.0 Introduction — Presents the purpose of the CMS work plan and background information regarding the site.

2.0 Technical Approach — Provides a brief description of the technical approach for completing the DNAPL investigation using the MIP.

3.0 Investigative-Derived Waste — Describes the procedures to be implemented for management of investigative-derived waste (IDW).

4.0 References — Lists the references used in this document.

Appendix A— Presents the findings and results from the Phase I MIP Pilot Study conducted on September 13, 2000.

Appendix B— Presents responses to SCDHEC comments on the CMS Work Plan, MIP Phase II Pilot Study, SWMU 166, Zone K, Revision 0.

1.4 Project Schedule

CH2M-Jones has provided the following preliminary schedule that includes the duration and anticipated date of completion for the MIP field investigation; data interpretation and evaluation; and preparation and submittal of the CMS MIP Pilot Study Report:

Task	Duration	Anticipated Completion Date
MIP Phase II Pilot Study Field Investigation	2 to 4 weeks	March 3, 2001
Groundwater Analysis, Data Interpretation and Evaluation	2 weeks	March 15, 2001
CMS MIP Pilot Study Report	3 weeks	March 29, 2001

SECTION 2.0

Technical Approach

2.0 Technical Approach

This section outlines the technical approach to the DNAPL investigation at SWMU 166 using the MIP technology. Specifically, it presents the MIP process and data collection needs, as well as the sample collection methodology for the confirmation samples using vertical profiling in the DNAPL target areas.

At a minimum, one groundwater profiler boring will be advanced to within 12 to 18 inches from 10 percent of the MIP locations. These locations will be selected in the field on the basis of electron capture detector (ECD) response results of the adjacent MIP boring. The objective is to collect most of the confirmatory samples at locations where VOCs are elevated, but to also collect a few samples at locations that are likely to have lower concentrations, based on the ECD response. Discrete groundwater samples will be collected and analyzed for VOCs using U.S. Environmental Protection Agency (EPA) method 8260B. The data from the MIP and the profiler will be compared to assess the degree of data correlation.

The underground utilities in the immediate areas surrounding the proposed MIP and confirmatory vertical profiler points will be identified and properly labeled prior to initiating, as well as during, the investigation activities.

The overall strategy for the investigation will be to target areas of elevated concentrations of dissolved TCE at SWMU 166 on the basis of the results presented in the *Zone K Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report* (EnSafe Inc. [EnSafe], 1999) and on the basis of the results from the MIP Phase I pilot study.

2.1 MIP Boring Locations

The initial MIP borings will be advanced in areas of elevated dissolved TCE concentration which include areas surrounding the existing MW locations 166GW05D, 166GW13D, 166GW07D, 166GW10D, and 166GW16D, and in the area of the former Geoprobe location 166GW063. These initial investigation locations with the proposed MIP boring locations are depicted in Figure 2-1. In addition, the MIP investigation will continue in the area of 166GW25D, which was investigated during the Phase I pilot study (CH2M-Jones, 2000). These initial investigation locations were selected as starting points, as previous analysis of groundwater samples from these wells and Geoprobe points contained highly elevated TCE

concentrations. MIP borings will be positioned in a 20-foot grid pattern surrounding the initial MIP location in each area. However, this grid pattern may be modified in the field on the basis of ECD readings and/or analytical results from the groundwater profiler samples. The location of subsequent MIP borings will be positioned radially outward in the grid pattern and will be evaluated in the field on the basis of the results from previous MIP borings advanced in the immediate area. As a result, not all of the proposed MIP locations depicted in Figure 2-1 may be investigated.

2.2 MIP Operations

CH2M-Jones will subcontract with Columbia Technologies to advance the MIP borings in the target areas of TCE-impacted groundwater. CH2M-Jones will provide a field hydrogeologist or engineer who will be responsible for all field operations. Each MIP boring will be advanced in the groundwater formation, beginning at the top of the saturated zone to the top of the Ashley Formation, at approximately 31 to 37 ft bls. An MIP and soil conductivity probe approximately 1.5 inches in diameter and 12 inches in length will be advanced through the subsurface; readings from the detection device will be obtained at each linear foot in the groundwater formation.

The MIP portion of the probe, developed and patented by Geoprobe Systems, Inc., is driven into the ground at the rate of approximately one foot per minute. The immediate area surrounding the thin polymer membrane is heated to approximately 80 to 125 degrees Celsius (°C), allowing rapid movement of VOCs to partition across the polymer membrane. After diffusing across the membrane, the VOCs partition into the carrier gas, which sweeps the back side of the membrane. It takes less than 1 minute for the carrier gas stream to travel through approximately 100 feet of inert tubing and reach the detectors used by the system.

The MIP probe will use an ECD and a photoionization detector (PID) to analyze the VOCs. The ECD was selected for its sensitivity and its reliability in analyzing halogens; the PID was selected based on TCE and 1,2-dichloroethene (1,2-DCE), the primary contaminants at the site, having low ionization potentials of less than 10 electron-volts (eVs). To evaluate the concentration of chlorinated solvents in the groundwater formation, a graph will be generated of the MIP-ECD and PID responses in micro-volts (μVs) versus depth in feet. The parameters recorded during the MIP advancement and then used to interpret the chlorinated solvent concentrations in groundwater include soil conductivity, speed, and temperature. MIP operating information and procedures were provided in the Appendix of the *CMS Work Plan, MIP Pilot Study Phase I* document (CH2M-Jones, 2000).

The soil conductivity portion of the probe will be used to evaluate local subsurface geology during the investigation. In general, at a given location, lower conductivities indicate sands; higher conductivities indicate silts and clays. The soil conductivity probe utilizes dipole measurement arrangement, involving an alternating electrical current that is passed from the isolated center pin of the soil conductivity probe to the probe body. The voltage response of the soil to the imposed current is measured across the same two points. The probe is reasonably accurate for measurement of soil conductivities in the range of 5 to 400 microsiemens per meter (mS/m).

2.3 Confirmatory Groundwater Sampling

To evaluate the MIP-ECD and PID response, one vertical profiler point will be advanced to within 12 to 18 inches from a minimum of 10 percent of the MIP locations. The locations of the vertical profiler points will be evaluated and selected in the field on the basis of ECD response from the previous 10 to 30 MIP borings. Confirmatory samples will be collected at locations where VOCs are elevated with a few samples collected at locations that are likely to have lower concentrations, based on the ECD response.

The vertical profiler equipment will be standard Geoprobe direct-push technology (DPT) devices, equipped with a well screen 6 inches in length for discrete groundwater sample collection. However, a 4-foot well screen will be selected for groundwater sample collection if the 6-inch well screen produces low purge yield causing air entrainment within the sample collection tubing. Experience during the Phase I MIP pilot study indicated that a 6-inch screen may not be effective in some areas of the clayey sand layer located at an approximate depth of 33 to 37 ft bls. The well screen length used during the Phase II pilot study investigation will be selected on the basis of the yield obtained during purging activities.

At a minimum, one groundwater sample will be collected from each vertical profiler point on the basis of the ECD response from the adjacent MIP boring. The groundwater samples will be delivered or sent via overnight carrier to an offsite laboratory where they will be analyzed for VOCs using EPA method 8260B. The groundwater analytical results will be compared to the ECD and PID response. The completed MIP and vertical profiler points will be filled to the ground surface with bentonite-grout slurry.

During the Phase II Pilot Study, VOC method blanks using EPA method 8260B will be completed by an offsite laboratory prior to the analysis of the confirmation samples collected from the vertical profiler points. Although method SW-846 provides guidance on

what the results of the method blank should be, CH2M-Jones will discuss this specific item with the laboratory performing the sample analyses. The laboratory used for sample analysis will verify that VOCs are not detected in the method blanks above the method detection limits prior to the analysis of the confirmation samples.

The groundwater analysis will follow the procedures found in the approved Comprehensive Sampling and Analysis Plan (CSAP) portion of the *Final Comprehensive RFI Work Plan* (EnSafe/Allen & Hoshall, 1994). The CSAP outlines all monitoring procedures to be performed during the investigation in order to characterize the environmental setting, source, and releases of hazardous constituents. In addition, the CSAP includes the Quality Assurance Plan (QAP) and Data Management Plan (DMP) to verify that all information and data are valid and properly documented.

The results of the MIP investigation will be summarized in a CMS MIP Pilot Study Report. The CMS Pilot Study Report will document the field activities completed during the MIP investigation; provide an interpretation and correlation of the MIP ECD and soil conductivity response, and the analytical results from the samples collected from the vertical profiler points; and present the interpreted vertical and horizontal extent of the target DNAPL source area.

Figure 2-1
Proposed MIP Locations
Corrective Measures Study Work Plan
MIP Phase II Pilot Study
Charleston Naval Complex - Zone K Annex

CH2MHILL

File Path: E:\Projects\Charleston\Figures\Apr\mip_grid.apr, Date: 31 Jan 2001 11:00, User: ASPOSATO

SECTION 3.0

Investigative-Derived Waste

3.0 Investigative-Derived Waste

IDW consisting of purge water and decontamination water from the MIP and vertical profiler will be collected in a labeled 55-gallon drum and left onsite in a secure location. Upon completion of the MIP field activities, a sample of the drum contents will be collected and analyzed for VOCs using EPA method 8260B. CH2M-Jones will arrange for the transportation of the drum and its contents to an offsite, licensed facility permitted to accept and treat solvent-impacted groundwater.

SECTION 4.0

References

4.0 References

EnSafe Inc./Allen & Hoshall. *Final Comprehensive RFI Work Plan*. May 31, 1994.

EnSafe Inc. *Zone K Resource Conservation and Recovery Act Facility Investigation Report, Charleston Naval Complex*. June 11, 1999.

CH2M-Jones. *Corrective Measures Study Work Plan, Membrane Interface Probe (MIP) Pilot Study, Phase I, Solid Waste Management Unit (SWMU) 166*. July 21, 2000.

APPENDIX A

Membrane Interface Probe Phase I Pilot Study Results

APPENDIX A

Membrane Interface Probe Phase I Pilot Study Results

Pilot Study Summary

The Phase I pilot study was completed on September 13, 2000 in the area of existing MW166GW025D. As part of the pilot study, Columbia Technologies advanced the MIP and vertical profiler points in the proposed locations, and used an onsite laboratory to analyze the groundwater samples collected from the vertical profile points. Six MIP borings (166MP001 through 166MP006) and three vertical profile points (166VP007 through 166VP009) were advanced during the one-day pilot study. With the exception of 166MIP001 and 166MIP002, which were advanced to an approximate depth of 43 and 40 ft bls, respectively, each MIP boring was terminated at an approximate depth of 37 ft bls. MIP borings 166MP002, 166MP004, and 166MP006 were advanced in a northeast to southwest transect; MIP borings 166MP005, 166MP003, and 166MP001 were positioned in a northwest to southeast transect. Groundwater samples were collected from vertical profile points to evaluate the effectiveness of the MIP technology. Vertical profile points 166VP007 and 166VP009 were advanced adjacent to the MIP point 166MP001; 166VP008 was positioned immediately adjacent to 166MP005. The MIP borings and the vertical profile locations are shown in Figure A-1.

MIP Results

The ECD response was minimal during the first 30 feet of advancement below land surface, which is consistent with the analytical results associated with the groundwater samples collected above 30 ft bls from the groundwater profiler (i.e., low levels or non-detect levels of TCE in groundwater). The ECD exhibited a significant response in each MIP boring at a depth from approximately 30 to 37 ft bls but varied slightly in magnitude (from 5E05 to 2E06 µVs in each of the six borings. In addition, the soil conductivity response in each MIP boring occurred at approximately the same depth, with an initial increase from the baseline of 0 mS/m, occurring at a depth of approximately 24 ft bls; and a second increase occurring in each boring at an approximate depth of 33 to 34 ft bls, terminating at an approximate depth of 37 ft bls. Each conductivity increase occurring at an approximate depth of 33 to 34 ft bls was less than 50 mS/m. The change in soil conductivity occurring at approximately 33

to 37 ft bls appears to be the interface between the clayey sand unit and overlying sandy unit, which was previously thought to be present at approximately 23 to 28 ft bls. As depicted in the MIP results from 166MIP001, the soil conductivity increased again at an approximate depth of 37 ft bls, denoting the top of the Ashley Formation. However, as the soil conductivity increased with depth until boring was terminated at approximately 43 ft bls, the ECD response dramatically decreased, indicating that chlorinated solvents had not penetrated to their depth. Of the MIP results from the six borings, higher ECD readings occurred in 166MP001 and 166MP002, with a response approaching 2E06 μV. The northeast to southwest transect and the northwest to southeast transect depicting the soil conductivity and ECD response in relation to depth are provided in Figures A-2 (a-d).

Groundwater Profiling Results

Groundwater samples were collected from vertical profile points to evaluate the effectiveness of the MIP technology. Groundwater samples were collected from a 6-inch Geoprobe groundwater profiler well screen inserted to depth using DPT. The samples were collected from approximate depths of 10, 20, and 35 ft bls from 166VP007; 20 and 31 ft bls from 166VP008; and 27, 30, 32, and 35 ft bls from 166VP009. The sample collection depths were selected to include regions within the saturated zone where there was no chlorinated solvent contamination and at discrete depths of impacted groundwater, based on the ECD reading from the adjacent MIP boring. The samples were analyzed for VOCs using EPA Method 8260A by the onsite laboratory operated by Columbia Technologies.

The vertical profile point 166VP007 was advanced adjacent to 166MP001 and the existing deep groundwater MW 166GW25D. TCE detected at a concentration of 280 micrograms per liter (μg/L) in the sample collected from 35 ft bls was the only contaminant detected above the laboratory detection limit in the three samples collected from 166VP007. The vertical profile point 166VP008 was advanced adjacent to the MIP boring 166MP005 located approximately 25 feet northwest of 166GW25D. Again, TCE was detected only (87 μg/L) in the sample collected below 30 feet and was the only contaminant detected in the two samples collected from 166VP008 above method detection limits. These initial analytical results did not correlate well with the adjacent MIP-ECD response readings or with historic analytical results from samples collected from the adjacent MW 166GW25D.

To further evaluate the magnitude of chlorinated solvents in the deep portion of the saturated zone in the immediate area of the pilot study, a groundwater sample was collected from MW 166GW25D and analyzed for VOCs using EPA method 8260A. TCE was

detected at a concentration of 14,500 µg/L. MW 166GW25D is screened from approximately 27.5 to 32.2 ft bls.

As a result of the elevated TCE concentration, the focus at the end of the pilot study was to confirm the results of the groundwater sample collected from 166GW25D and the elevated ECD response from the MIP boring 166MP001 advanced adjacent to 166GW25D. To do so, additional samples were collected and analyzed using groundwater profiling in the immediate area of these locations. A third vertical profile location, 166VP009, was advanced adjacent to the MIP boring 166MP001 and the initial vertical profile location 166VP007. However, modifications were made during the sample collection activities, specifically attempting to collect samples at depths within the formation that produced elevated purge yields. Although 166VP009 was advanced adjacent to 166VP007, the groundwater purge yield achieved from 166VP009 was greater during sample collection. In addition, a deep groundwater sample was collected from a 4-foot well screen in lieu of the 6-inch Geoprobe groundwater profiler well screen inserted to depth. By using the 4-foot well screen, groundwater yield increased during well purging and a more favorable sample was collected, representing the deeper portion saturated zone above the Ashley Formation. Groundwater samples collected from the deeper depths (i.e., greater than 30 ft bls) in the vertical profile locations 166VP007 and 166VP008 were difficult to obtain due to sample yield, and the 6-inch well screen became clogged with the fine silty material overlying the Ashley Formation. The low purge yield caused air entrainment within the sample collection tubing, which may have caused TCE to be detected at lower concentrations.

TCE was detected at a concentration of 10,000 µg/L in the groundwater sample collected from the 4-foot well screen placed at an approximate interval of 31 to 35 ft bls. In addition, TCE was detected at concentrations of 750 µg/L, 2,130 µg/L, and 5,750 µg/L in the groundwater samples collected using the 6-inch groundwater profiler at depths of 30, 32, and 35 ft bls, respectively. Also, 1,2-DCE was detected in these three samples at concentrations of 16 µg/L, 68 µg/L, and 130 µg/L (J) ("J" indicates an estimated value), respectively. The concentration of 1,2-DCE in the sample collected from 35 ft bls was estimated due to sample dilution resulting from elevated TCE in the sample.

With the exception of the groundwater samples collected from MW 166GW25D, and the sample collected from 166VP007 at a depth of 35 ft bls, each sample was analyzed for methane, ethane, and ethene using EPA Method 8260A by the onsite laboratory. In general, the methane concentration increased at each vertical profile point with increasing depth. A summary of the analytical data from the samples collected during the Phase I pilot study, including the analysis for methane, ethane, and ethene, are provided in Table A-1. Field

parameters collected during groundwater sample collection including flow rate, pH, oxidation/reduction potential (ORP), conductivity, temperature, and dissolved oxygen for the sample collected at 10 ft bls from the vertical profile point 166VP007 are provided in Table A-2. These field parameters were not collected after the initial sample due to time constraints.

The completed MIP and vertical profiler borings were filled to the ground surface with bentonite pellets.

Findings and Conclusions

The MIP was represented by Geoprobe as a fast, effective method for collecting real-time semi-quantitative data on VOC concentrations in groundwater. The MIP Phase I pilot test concluded that it is effective for this purpose. Figure A-3 provides a graphical comparison of the ECD and soil conductivity results from 166MP001 with the groundwater analytical results from the samples collected from the adjacent vertical profiler point 166VP009. Figure A-3 presents the best correlation of the ECD readings to the groundwater analytical results using the gas chromatograph/mass spectrometer (GC/MS). A comparison of the data identifies an increase in contaminant concentration in the samples collected from the vertical profiler and an increase in ECD response as the depth of the boring increases. Using the data presented in the graph, a detected TCE concentration of 1,000 µg/L represents an approximate ECD response of 1.4E6 to 1.7E6 µV.

Table A-3 provides a summary comparison of the analytical results from the vertical profiler samples to the MIP ECD response as a function of depth.

The findings and interpreted comparison of the ECD readings to the groundwater analytical results will be used to establish the footprint for the Phase II MIP investigation at SWMU 166.

Samples Collected:	########	Collected by:	R. Brand	Client:	CH2MHill Constructors
Samples Received:	########	Received by:	D. McInnes	Client Address:	225 East Robinson Street, Suite 505
Samples Analyzed:	########	Analyzed by:	D.McInnes		
Samples Reported:	########	Reported by:	Doug McInnes		
Project Identification:	MIPS Demo, Chas SC	Report Revision:	0.0	Client Contact:	Casey Hudson
Columbia Job Code:		Method Deviations:	none	Client Phone:	407-423-0001 x251
Purchase Order:		Sampling Method:	Direct Push	Client Fax:	407-839-5901

USEPA Method 8260 Water Sample Analysis Results in ug/L

Compound/Location Depth	PQL[1] (ug/L)	166VP007 10 (ug/L)		166VP007 20 (ug/L)		166VP007 35 (ug/L)		166VP008 20 (ug/L)		166VP008 31 (ug/L)		166VP009 27 (ug/L)		166VP009 30 (ug/L)		166VP009 32 (ug/L)		166VP009 35 (ug/L)		166GW25D 18 (ug/L)	
Dichlorodifluromethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Chloromethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Vinyl Chloride	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	2	J	2500	U
Bromomethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Chloroethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,1-Dichloroethene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	2	J	2500	U
Methylene Chloride	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
trans-1,2-dichloroethene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	2	J	2500	U
1,1-Dichloroethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
cis-1,2-Dichloroethene	5	5	U	5	U	50	U	5	U	5	U	5	U	16		68		130	JD	2500	U
Chloroform	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,1,1-Trichloroethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,2-Dichloroethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,2-Dichloropropane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Benzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Carbon Tetrachloride	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Trichloroethylene	5	4	JB	5	JB	280	BD	8	B	87	BD	19	B	750	EB	2170	EB	5750	BD	14500	B
Bromodichloromethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
cis-1,3-Dichloropropene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Toluene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,1,2-Trichloroethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
trans-1,3-Dichloropropene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Dibromochloromethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,2-Dibromoethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Tetrachloroethylene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Chlorobenzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Ethylbenzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
m+p Xylene	10	10	U	10	U	100	U	10	U	10	U	10	U	10	U	10	U	10	U	5000	U
Bromoform	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Styrene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
o-Xylene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,1,2,2-Tetrachloroethane	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,3-Dichlorobenzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,4-Dichlorobenzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,2-Dichlorobenzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
1,2,4-Trichlorobenzene	5	5	U	5	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	2500	U
Dilution Factor:		1		1		10		1		10, 1		1		1		1		1, 100		500	

U: Non-detect result
J: Estimated value - less than PQL
D: Dilute result
E: Estimated value - greater than upper limit of calibration curve
B: Compound found in associated method blank

1 PQL: Practical quantitation limit using the initial calibration curve low point and dilution factors where applicable

SAMPLE NARRATIVE: Due to the presence of low levels of trichloroethane found in the method blanks, low-level detects for this compound should be used with caution.

Quality Control Analyst: _____

Compound	PQL[1] (ug/L)	166VP009 31-35 (ug/L)	
Dichlorodifluoromethane	5	500	U
Chloromethane	5	500	U
Vinyl Chloride	5	500	U
Bromomethane	5	500	U
Chloroethane	5	500	U
1,1-Dichloroethene	5	500	U
Methylene Chloride	5	500	U
trans-1,2-dichloroethene	5	500	U
1,1-Dichloroethane	5	500	U
cis-1,2-Dichloroethene	5	500	U
Chloroform	5	500	U
1,1,1-Trichloroethane	5	500	U
1,2-Dichloroethane	5	500	U
1,2-Dichloropropane	5	500	U
Benzene	5	500	U
Carbon Tetrachloride	5	500	U
Trichloroethylene	5	10000	B
Bromodichloromethane	5	500	U
cis-1,3-Dichloropropene	5	500	U
Toluene	5	500	U
1,1,2-Trichloroethane	5	500	U
trans-1,3-Dichloropropene	5	500	U
Dibromochloromethane	5	500	U
1,2-Dibromoethane	5	500	U
Tetrachloroethylene	5	500	U
Chlorobenzene	5	500	U
Ethylbenzene	5	500	U
m+p Xylene	10	1000	U
Bromoform	5	500	U
Styrene	5	500	U
o-Xylene	5	500	U
1,1,2,2-Tetrachloroethane	5	500	U
1,3-Dichlorobenzene	5	500	U
1,4-Dichlorobenzene	5	500	U
1,2-Dichlorobenzene	5	500	U
1,2,4-Trichlorobenzene	5	500	U

Dilution Factor: 100

U: Non-detect result J: Estimated value - less than PQL D: Dilute result E: Estimated value - greater than upper limit of calibration curve
B: Compound found in associated method blank

PQL: Practical quantitation limit using the initial calibration curve low point and dilution factors where applicable

SAMPLE NARRATIVE: Due to the presence of low levels of trichloroethane found in the method blanks, low-level detects for this compound should be used with caution.

Quality Control Analyst: _____

Samples Collected:	########	Collected by:	R. Brand	Client:	CH2MHill Constructors
Samples Received:	########	Received by:	D. McInnes	Client Address:	225 East Robinson Street, Suite 505
Samples Analyzed:	########	Analyzed by:	D.McInnes		
Samples Reported:	########	Reported by:	Doug McInnes		
Project Identification:	MIPS Demo, Chas SC	Report Revision:	0.0	Client Contact:	Casey Hudson
Columbia Job Code:		Method Deviations:	none	Client Phone:	407-423-0001 x251
Purchase Order:		Sampling Method:	Direct Push	Client Fax:	407-839-5901

USEPA Method 8260 Water Sample Analysis Results in ug/L

Compound	PQL[1]	166VP007 10		166VP007 20	166VP007 35	166VP008 20	166VP008 31	166VP009 27	166VP009 30	166VP009 32	166VP009 35	166GW25D 18	166VP009 31-35
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Methane	0.015	1.406		1.125	NR	3.677	18.23	2.256	15.26	59.34	69.81	NR	74.26
Ethane	0.005	0.005	U	0.01	NR	1.114	3.781	0.422	1.165	2.006	0.682	NR	0.218
Ethylene	0.005	0.021		0.029	NR	0.783	2.418	0.369	1.913	10.203	2.917	NR	2.148
Dilution Factor:		1		1	1	1	1	1	1	1	1	1	1

U: Non-detect result
J: Estimated value - less than PQL
B: Compound found in associated method blank
D: Dilute result
E: Estimated value - greater than upper limit of calibration curve
NR: Not Run, no result available

U: Non-detect result
J: Estimated value - less than PQL
B: Compound found in associated method blank
D: Dilute result
E: Estimated value - greater than upper limit of calibration curve
NR: Not Run, no result available

1 PQL: Practical quantitation limit using the initial calibration curve low point and dilution factors where applicable

SAMPLE NARRATIVE:

Quality Control Analyst: _____

ME

Samples Collected:	09/13/2000	Collected by:	R. Brand	Client:	CH2MHill
Samples Received:	09/13/2000	Received by:	D. McInnes	Client Address:	
Samples Analyzed:	09/13/2000	Analyzed by:	D.McInnes		
Samples Reported:	09/13/2000	Reported by:	Doug McInnes		
Project Identification:	MIPS Demo, Chas SC	Report Revision:	0.1	Client Contact:	
Columbia Job Code:		Method Deviations:	none	Client Phone:	
Purchase Order:		Sampling Method:	Direct Push	Client Fax:	

VOC METHOD BLANK RESULTS

	Sample ID:	MB091200-02		MB091200-03		MB091300-01		MB091300-02		MB091300-03		MB091300-04		MB091300-05	
	Analysis Date:	09/12/2000		09/12/2000		09/13/2000		09/13/2000		09/13/2000		09/13/2000		09/13/2000	
	PQL (ug/L)														
Dichlorodifluromethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,2-dichloroethene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,2-Dichloroethene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	5	U	5	U	5	U	5	U	17		5	U	5	U
1,1,1-Trichloroethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Benzene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethylene	5	5	U	4	J	3	J	4	J	4	J	4	J	4	J
Bromodichloromethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethylene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
m+p Xylene	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Bromoform	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
o-Xylene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	5	U	5	J	5	U	5	U	5	U	5	U	5	U
	Dilution Factor:	1		1		1		1		1		1		1	

U: Non-detect result E: Estimated value - greater than upper limit of calibration curve J: Estimated value - less than PQL

1 PQL: Practical quantitation limit using the initial calibration curve low point and dilution factors where applicable

SAMPLE NARRATIVE: MB091200-2 S3 LOW

Quality Control Analyst:

TABLE A-1

Field Data Sheet

Well Number:	166VP007-10	Stick Up:	2 '
Date:	09/13/2000	Well Depth:	10'
Time:	11:00	Screen Interval:	9.5-10'
Well Diameter:	1.75"	Depth to Water (bgs)	4.45

Well Purge: Peristaltic Pump Pump Start Time: 11:23

Time	Purge Flow Rate (ml/min)	pH	ORP (mv)	Cond. (mS/cm)	Temp (oC)	Dissolved Oxygen (mg/L)
11:40	75	5.92	49.1	140	27.87	5.40
11:45	75	5.88	63.0	98	27.70	6.12
11:50	75	5.80	82.9	69	27.75	6.34
11:55	75	5.73	98.3	56	27.70	6.40
12:00	75	5.67	105.5	50	27.30	6.45
12:05	75	5.65	115.1	48	27.85	6.40

SAMPLE COLLECTION

Time

12:07 2 - 40 ml VOA for VOC.

12:07 2 - 40 ml VOA for Dissolved Gas

TABLE A-3

Comparison of MIP Electron Capture Detector (ECD) Results and Vertical Profiler Groundwater Sample Analytical Results

CMS Work Plan, MIP Phase II Pilot Study, SWMU 166, Zone K, Charleston Naval Complex

MIP/Vertical Profiler (Groundwater Monitoring Well) Pair	Vertical Profiler Sample Collection Depth (ft bls)	Sample Screen Length (feet)	ECD Response (µV)	Trichloroethene Concentration (µg/L)	Total Chlorinated Solvent Concentration[1] (µg/L)
166MP001 166VP007	10	0.5	0E+00 (Baseline)	4J	4
	20	0.5	0E+00 (Baseline)	5J	5
	35	0.5	0.75E+06 - 2E+06	280	280
166MP001 166VP009	27	0.5	0E+00 (Baseline)	19	19
	30	0.5	0.25E+06 - 0.75E+06	750E	766
	32	0.5	0.75E+06 - 1.5E+06	2,170E	2238
	35	0.5	0.75E+06 - 2E+06	5,750	5,886
	31-35	4.0	0.5E+06 - 2E+06	10,000	10,000
166MP001 166GW25D	27.5-32.2	4.7	0E+00 (Baseline) – 1.5E+06	14,500	14,500
166MP005 166VP008	20	0.5	4E+05 (Baseline)	8	8
	31	0.5	6.3E+05	87	87

Notes:

1 Total chlorinated solvent concentration is the summation of vinyl chloride, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and tetrachloroethene concentrations above the laboratory detection limit.

J – Indicates an estimated value.

E – Indicates an estimated value – greater than upper limit of calibration curve.

ft bls – feet below land surface

µV – micro-volts

µg/L - micrograms per liter

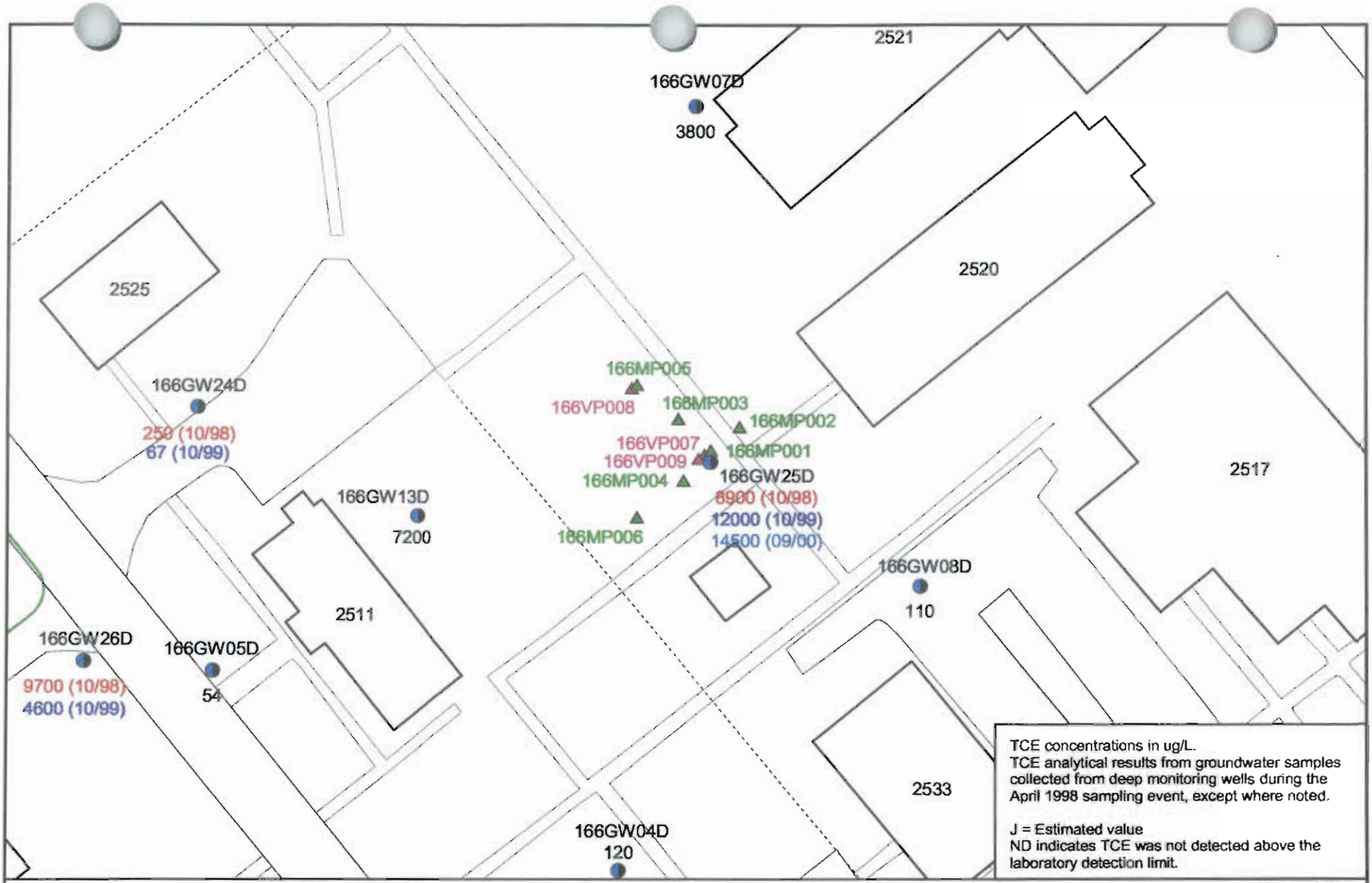
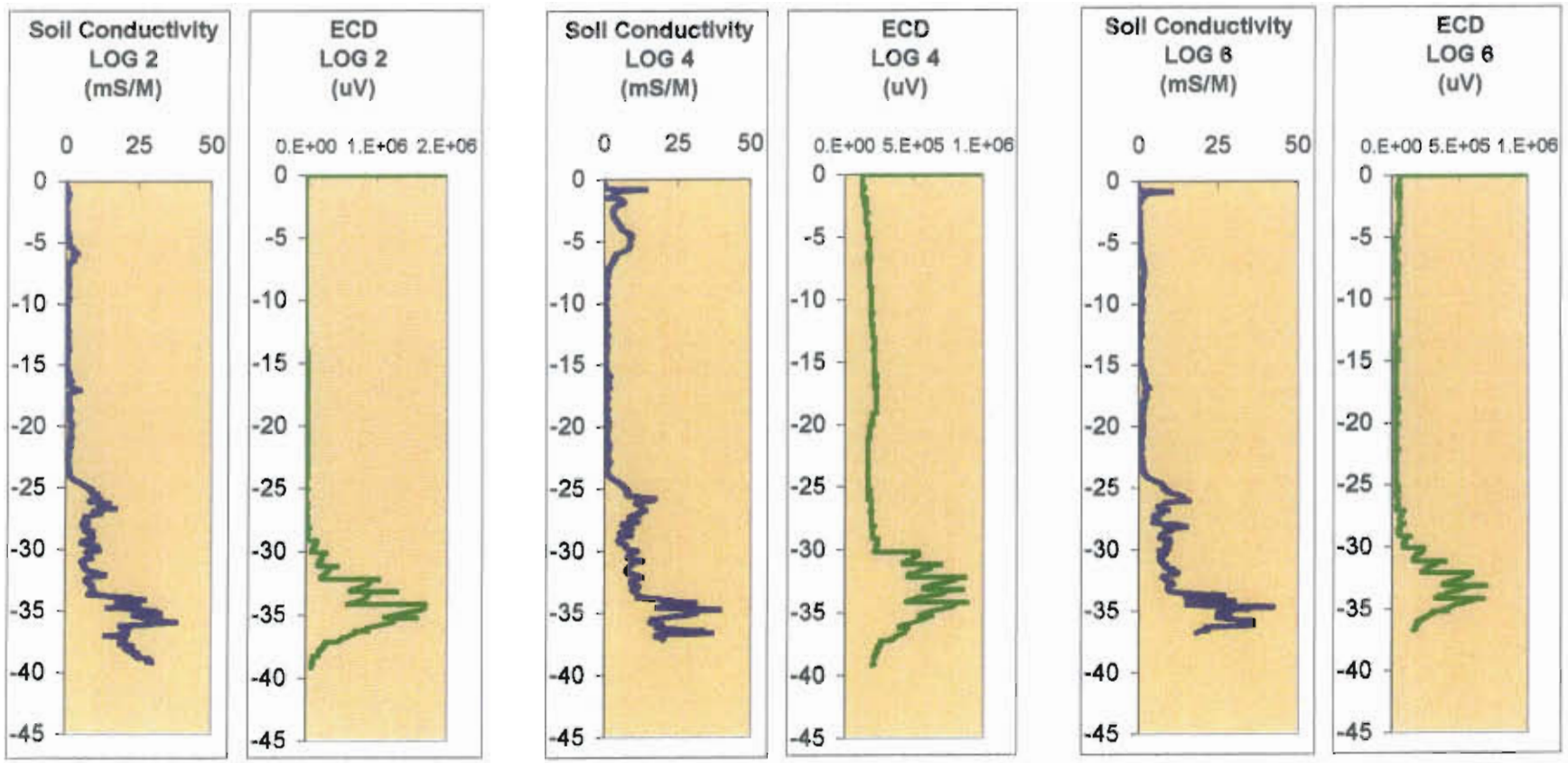


Figure A-1
SWMU 166 MIP/Vertical Profiler Locations
Corrective Measures Study
MIP Phase I Pilot Study
Charleston Naval Complex Annex - Zone K Annex

CH2MHILL

File Path: E:\Projects\Charleston\Figures\Aprs\oms_zonek.apr, Date: 24 Oct 2000 16:20, User: ASPOSATO

SWMU 166 MIP Data
Transect from Northeast to Southwest



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1-888-344-2704

FIGURE A-2a

Charleston Transect
From North-East to South-West

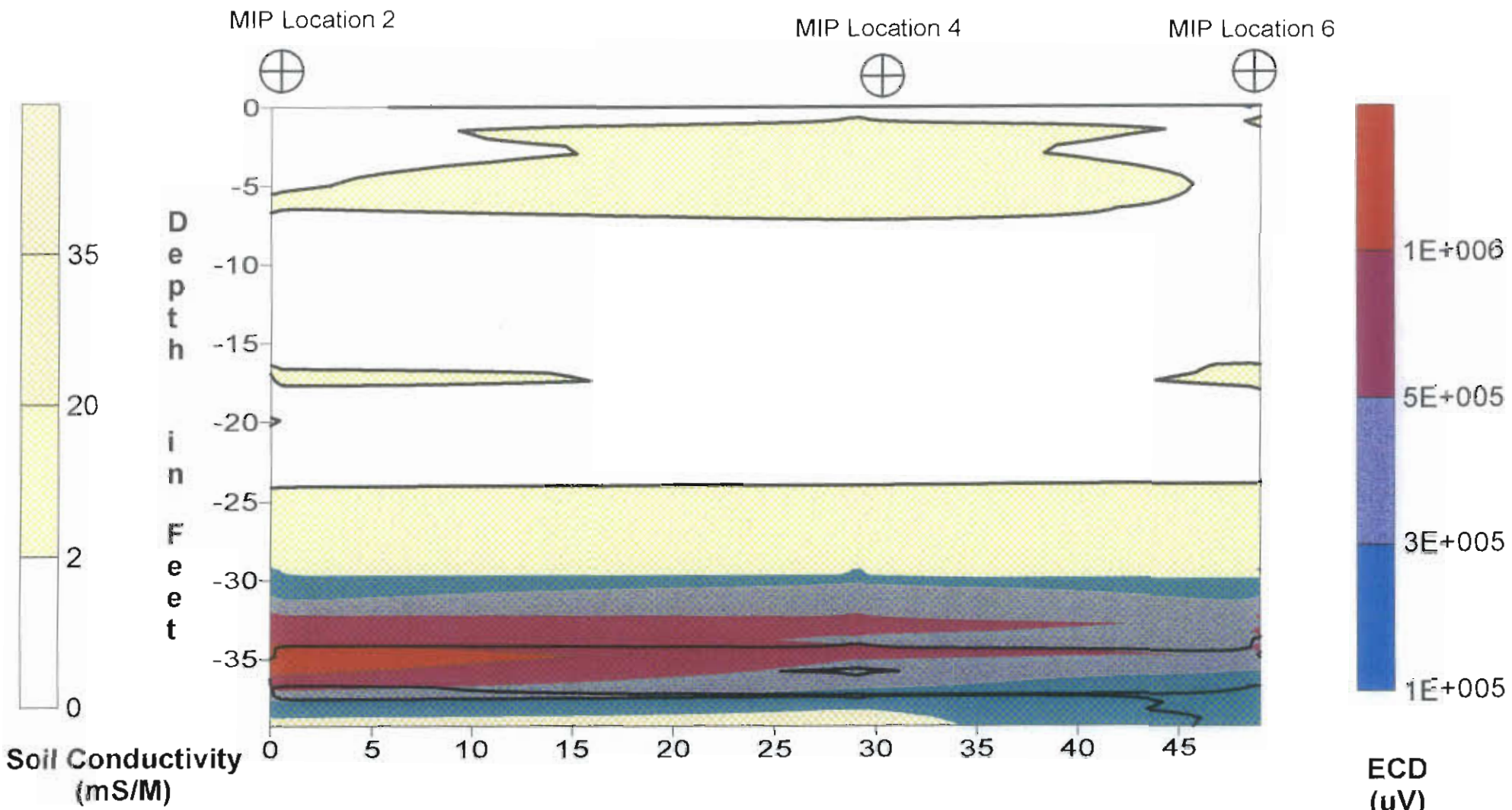

FIGURE A-2b

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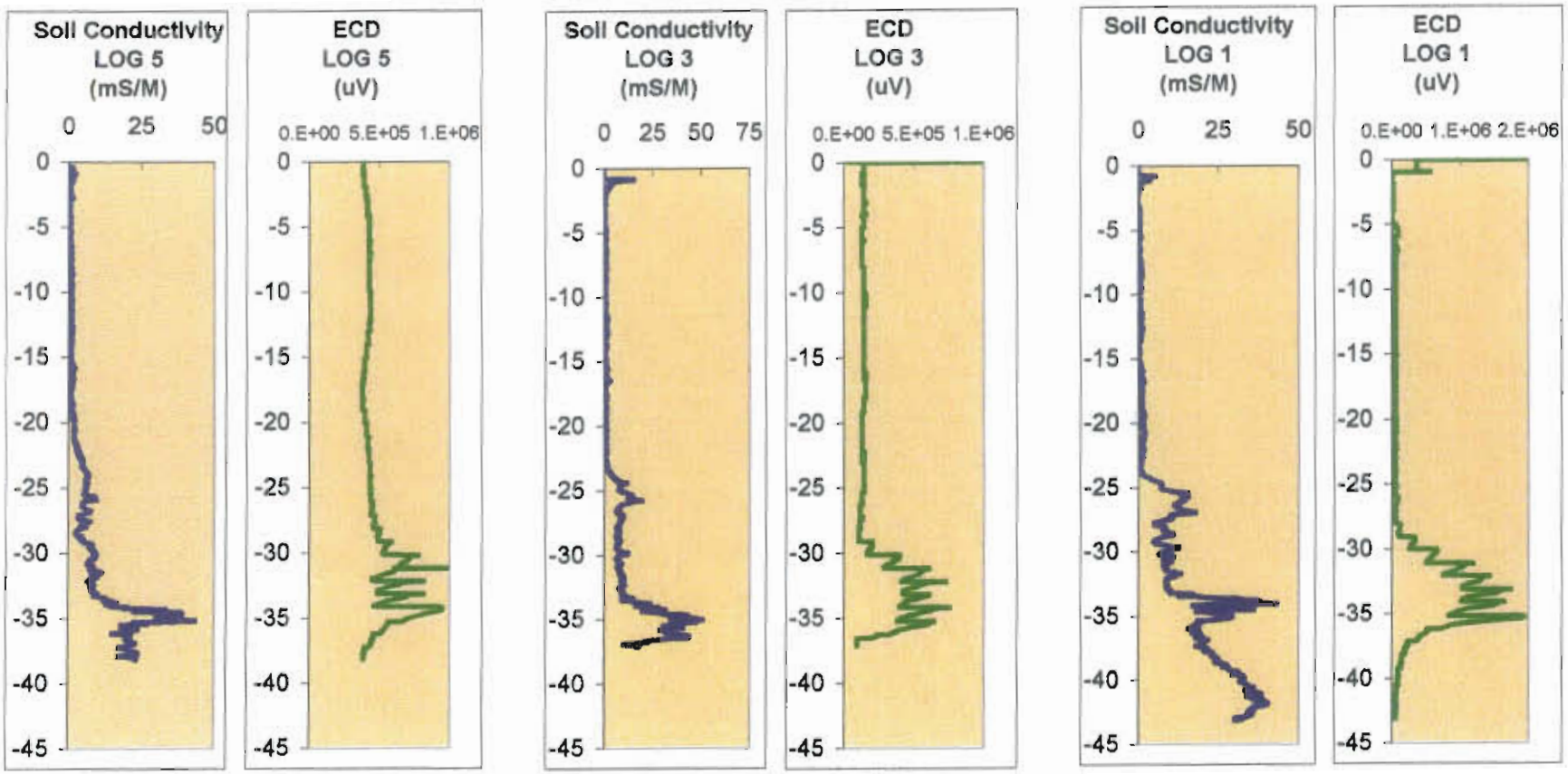
SWMU 166 MIP Data
Transect from Northwest to Southeast



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1-888-344-2704

FIGURE A-2c

Charleston Transect
From North-West to South-East

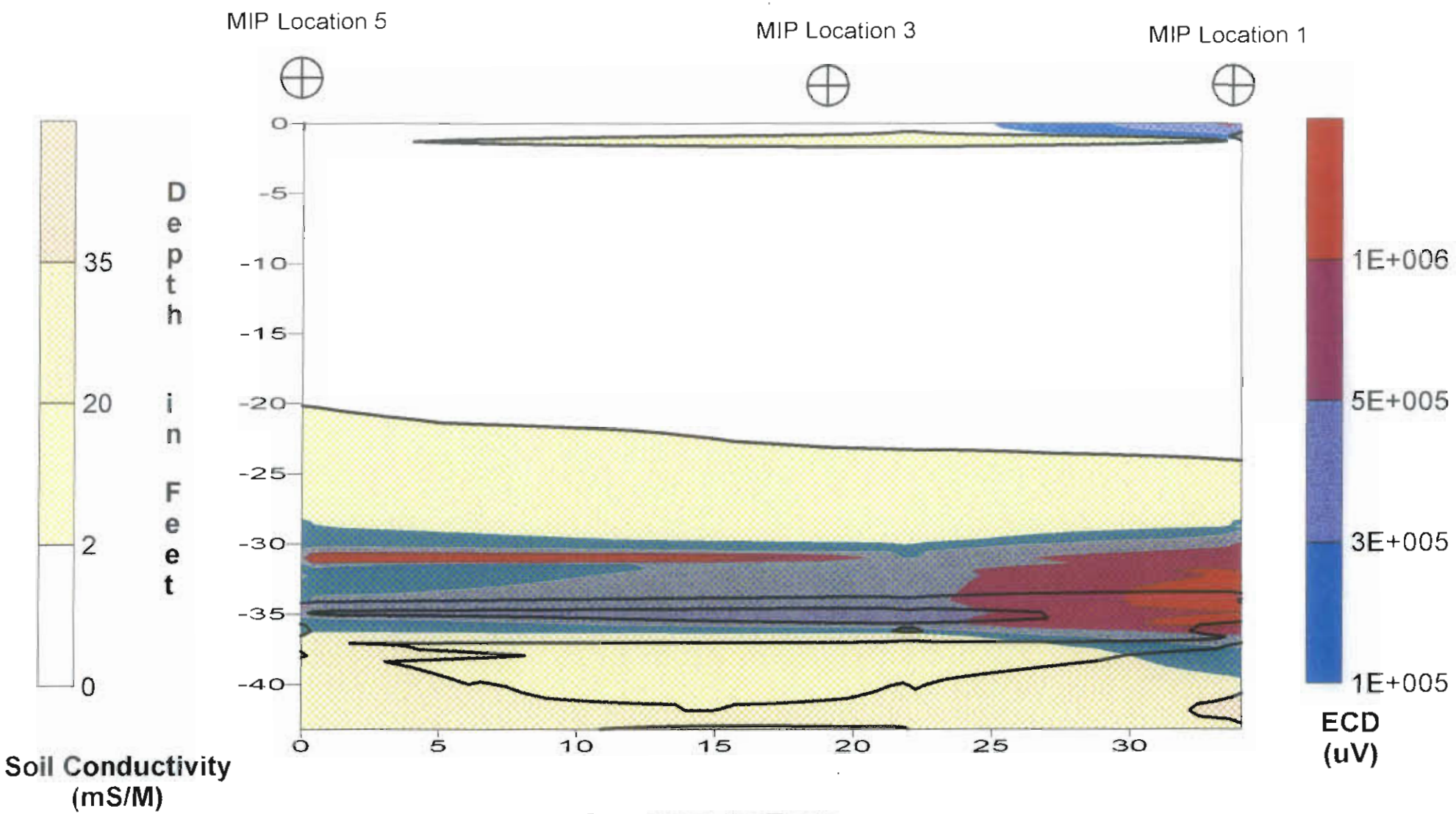

FIGURE A-2d

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SWMU 166 MIP Data

Comparison of MIP Results (166 MP001) with Vertical Profile Water Samples (166 VP009) and Monitoring Well Samples (166 GW25D)

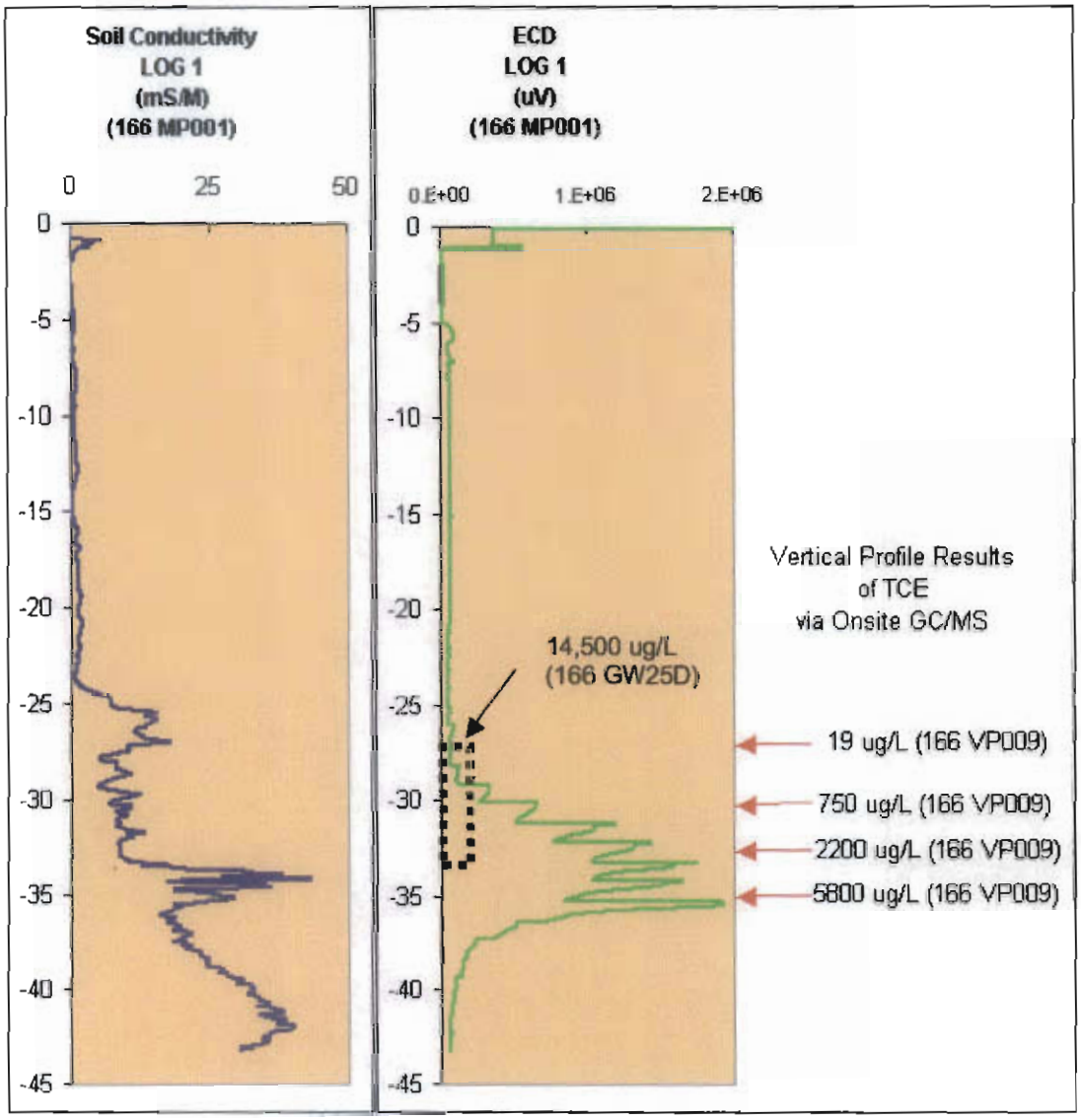

Figure A-3

Comment:

1. Figures 1-1 and 1-2

   The figures use different colors to represent total chlorinated VOCs in µg/l in groundwater, however the colors between 10 and 1000 to > 10000 are indistinguishable. Different shapes to represent different analytical results would improve the readability of these figures. Revision to this document is not necessary however future workplans and reports should be improved.

   It must be noted that numerous groundwater samples were collected by direct push technology (DPT). A large number of DPT samples did not report any contamination. The DPT analytical data, especially the non-detect data, must be used with caution since the samples were collected from a 6-inch screen at a fixed depth.

   It must also be noted that monitoring wells installed more than five feet above the top of the Ashley Formation are likely NOT to detect groundwater contaminants, which are present. An example of this can be found at well 166GW05D. It is imperative to understand the effect of the proximity of the top of the Ashley Formation on all samples and monitoring wells. The top of the Ashley Formation should be represented in future workplans and reports.

Response:

In future deliverables contour lines on potentiometric surface maps and contaminant contour maps will be modified for clarification by using color and/or shape to differentiate between adjacent lines.

A graphical representation of the top of the Ashley Formation in the area of SWMU 166, as evaluated by soil conductivity response will be presented in future submittals such as the IM Work Plan and the CMS Report. The IM Work Plan for SWMU 166 will describe and document the remedial technology approach and implementation of six phase heating or another source removal technology, which would be implemented as an IM prior to the development of the CMS. Once the IM is completed, a CMS Work Plan for an actual CMS Report will be prepared.

Comment:

2. Section 2.0, Page 2-1

   This sections (sic) states that "A groundwater profiler boring will be advanced to within 12 to 18 inches of approximately 10 percent of the MIP locations." Please explain in the revised workplan the criteria used to select the groundwater profiler locations.

Response:

The MIP Phase II Pilot Study, CMS Work Plan, will be revised to state the following:

At a minimum, one groundwater profiler boring will be advanced to within 12 to 18 inches from 10 percent of the MIP locations. These locations will be selected in the field on the basis of electron capture detector (ECD) response results of the adjacent MIP boring. The objective is to collect most of the confirmatory samples at locations where

VOCs are elevated but to also collect a few samples at locations that are likely to have lower concentrations, based on the ECD response.

Comment:

3. Section 2.3, Page 2-3

   This section states that the vertical profiler well screen will be selected in the field based on well purging yields. Please explain in the revised workplan the criteria used to select the well screen length.

Response:

The first paragraph of Section 2.3 of MIP Phase II Pilot Study, CMS Work Plan will be deleted and replaced with the following text:

To evaluate the MIP-ECD and PID response, one vertical profiler point will be advanced to within 12 to 18 inches from a minimum of 10 percent of the MIP locations. The locations of the vertical profiler points will be evaluated and selected in the field on the basis of ECD response from the previous 10 to 30 MIP borings. Confirmatory samples will be collected at locations where VOCs are elevated with a few samples collected at locations that are likely to have lower concentrations, based on the ECD response.

The vertical profiler equipment will be standard Geoprobe direct-push technology (DPT) devices, equipped with a 6-inch-long well screen for discrete groundwater sample collection. However, a 4-foot well screen will be selected for groundwater sample collection if the 6-inch well screen produces low purge yield causing air entrainment within the sample collection tubing. Experience during the Phase I MIP pilot study indicated that a 6-inch-length screen may not be effective in some areas of the clayey sand layer located at an approximate depth of 33 to 37 feet below land surface (ft bls). The well screen length used during the Phase II pilot study investigation will be selected on the basis of the yield obtained during purging activities.

At a minimum, one groundwater sample will be collected from each vertical profiler point on the basis of the ECD response from the adjacent MIP boring. The groundwater samples will be delivered or sent via overnight carrier to an offsite laboratory where they will be analyzed for VOCs using United States Environmental Protection Agency (EPA) method 8260B. The groundwater analytical results will be compared to the ECD and PID response. The completed MIP and vertical profiler points will be filled to the ground surface with bentonite-grout slurry.

Comment:

4. Section 3.0, Page 3-1

   This section states "Once the analytical results have been reviewed, the 55-gallon drum with the groundwater contents will be hauled by the U.S. Naval Detachment (AKA EEG) for offsite treatment." It is not clear in the text what analytical results are being referred to. In a 7 December 2000 telephone conversation, Mr. Casey Hudson confirmed that a sample from the drum be run through the onsite gas chromatograph/mass spectrometer (GC/MS). Please include this information and the analytical parameters in the revised workplan.

Response:

Section 3.0 of the MIP Phase II Pilot Study, CMS Work Plan, will be revised to state the following:

IDW consisting of purge water and decontamination water from the MIP and vertical profiler will be collected in a labeled 55-gallon drum and left onsite in a secure location. At the completion of the MIP field activities, a sample of the drum contents will be collected and analyzed for VOCs using EPA method 8260A by an onsite GC/MS or an offsite laboratory. CH2M-Jones will arrange for the transportation of the drum and its contents to an offsite licensed facility permitted to accept and treat solvent-impacted groundwater.

Comment:

5. Appendix, Groundwater Profiling Results, Pages A-3 and A-4

   Two items in this section discussed findings but failed to include the information in the appendix. Lines 13-24 on page A-3 discussed purge yields but only partial data in table A-2 was provided. Lines 1-3 on page A-4 state that analysis for methane, ethane and ethene are provided in Table A-1. This analytical information could not be located. Revisions to this document are not necessary however future workplans and reports should include all relevant data.

Response:

As presented in the first paragraph on page A-4, due to time constraints field parameters including flow rate, pH, oxidation/reduction potential (ORP), conductivity, temperature, and dissolved oxygen were not collected after the initial sample collected at 10 feet below land surface (ft bls) from the vertical profile point 166VP007.

Methane, ethane, and ethene results were inadvertently omitted from the report and will be provided in the revised MIP Phase II Pilot Study, CMS Work Plan.

Comment:

6. Figures A-2a through A-2d

   It is not clear on these figures if the well and sample elevations are from Mean Sea Level or have been measured from the surface at that location. This could have significant impact on data interpretation. Revisions to this document are not necessary, however future workplans and reports should clearly reference the elevation datum.

Response:

Each of the Figures A-2a through A-2d depicting the soil conductivity and ECD response as a function of depth initiates at a reference datum of zero indicating the land surface. This nomenclature is consistent with the text provided in the appendix, which references the soil conductivity and ECD response as a function of feet below land surface.

Comment:

7. VOC Method Bland Results

   It is noted that Trichloroethylene was detected in method blanks at 4 parts per billion. These detections and the implications of the detections were not addressed in the document. Please explain the effects of blank contamination on this data and how blank contamination during field implementation will be addressed in the revised workplan.

Response:

VOC method blanks using EPA method 8260A were completed by the onsite GC/MS prior to the analysis of the confirmation samples collected from the vertical profiler points. It was noted that trichloroethene was detected in the method blanks at an estimated concentration below the method detection limit of 5 µg/l. The objective of the Phase I Pilot Study was to evaluate the viability of using the MIP instrument to characterize the magnitude and extent of elevated concentrations of chlorinated solvents in groundwater at SWMU 166. The MIP results were compared to the analytical results from the samples collected from the adjacent vertical profiler points, which were 2 to 4 orders of magnitude above the method detection limit. Although it is important to note the detection of TCE below the detection limit in the method blank, its effect or significance in the evaluation and correlation of the MIP ECD response to the analytical results from the samples collected from the vertical profiler points is minimal. If we follow the USEPA National Functional Guidelines for Organic Data Review and apply the 5X rule as it relates to blank contamination, the results for trichloroethene in samples 166VP007-10, 166VP007-20, 166VP008-20, and 166VP009-27 would be qualified as "not detected", due to possible field or laboratory contamination. All other concentrations reported were well above the concentration level that may be attributable to possible contamination, and are most likely representative of environmental site conditions.

During the Phase II Pilot Study, VOC method blanks using EPA method 8260A will be completed by an offsite laboratory prior to the analysis of the confirmation samples collected from the vertical profiler points. Although method SW-846 provides guidance on what the results of the method blank should be, CH2M-Jones will discuss this specific item with the laboratory performing the sample analyses. The laboratory used for sample analysis will verify that VOCs are not detected in the method blanks above the method detection limits prior to the analysis of the confirmation samples.

Comment:

1. Section 1.3. Organization of the CMS Work Plan. Page 1-2.

   This section does not mention a subsection that details the schedule for field implementation (time and associated activities) of the proposed action. The schedule should also present the time period for the development and submittal of the CMS report. This information is required in accordance to the CNC Hazardous Waste Permit Condition II.G.1. "Corrective Measures Study (CMS) Work Plan. Please revise the document to adequate (sic) address this comment.

Response:

CH2M-Jones will include Section 1.4 in the revised MIP Phase II Pilot Study, CMS Work Plan which will addresses the project schedule including the duration and anticipated date of completion for the MIP field investigation, data interpretation and evaluation, and preparation and submittal of the CMS report. However, it should be remembered that the purpose of this CMS work plan is to complete the delineation of the target treatment area for implementation of six phase heating or another source removal technology, which would be implemented as an IM prior to the development of the CMS. Once the IM is completed, a CMS work plan for an actual CMS will be prepared.

Comment:

2. Section 2.3, Confirmatory Groundwater Sampling. Page 2-3.

   Lines 26-29 states that MIP investigation will be summarized in a report as an appendix to the proposed Interim Measures Work Plan. The CMS report for the proposed CMS Pilot Study should be developed and submitted as a separate document. The report should, at a minimum, describe the MIP field activities, interpret the MIP data, correlate the MIP, Geoprobe, and groundwater monitoring well data, and illustrate the vertical and horizontal extent of the target DNAPL source area. Please revise the text accordingly.

Response:

The last paragraph in Section 2.3 of the MIP Phase II Pilot Study, CMS Work Plan, will be revised to state the following:

The results of the MIP investigation will be summarized in a CMS MIP Pilot Study report. The CMS pilot study report will document the field activities completed during the MIP investigation; provide an interpretation and correlation of the MIP electron capture detector (ECD) and soil conductivity response; and the analytical results from the samples collected from the vertical profiler points; and present the interpreted vertical and horizontal extent of the target dense non-aqueous phase liquid (DNAPL) source area.

Comment:

3. Figure 2-1. Proposed MIP Locations

   The legend for the figure fails to provide the information that describes the solid pink triangular symbol. Please revise the figure.

Response:

The solid pink triangular symbol was not used in Figure 2-1 and as a result inadvertently remained in the legend. The solid pink triangular symbol will be removed from the legend in the revised figure 2-1.

Comment:

4. Figure A-3. Comparison of MIP Results with Vertical Profile Water Samples.

   The figure fails to indicate what sample location(s) were used to illustrate the comparison of MIP results with vertical profile water samples.

   Also, the Department recommends the Navy to provide similar illustrative figure for comparing results from groundwater well 166GW25D, vertical profile water sample 166VP009, and MIP boring 166MP001. The text on pages A-2 and A-3 describes the results for these sample locations.

Response:

Lines 14-18 on page A-4 states the following:

"Figure A-3 provides a graphical comparison of the ECD and soil conductivity results from 166MP001 with the groundwater analytical results from the samples collected from the adjacent vertical profiler point 166VP009. Figure A-3 presents the best correlation of the ECD readings to the groundwater analytical results using the GC/MS." Figure A-3 will be revised to identify the analytical results from the vertical profiler 166VP009 and 166GW25D with the ECD and soil conductivity results from 166MP001.

In addition, table A-3 will be added to appendix A that will provide the ECD response and the analytical results from the adjacent vertical profiler samples as a function of depth.

Because groundwater samples were collected at 4 discrete depths [i.e., 27, 30, 32, and 35 feet below land surface (ft bls)] from the vertical profiler point 166VP009 it was selected as the preferred comparison to the ECD response from the adjacent MIP boring 166MP001. The sample collected from the monitoring well 166GW25D was compared to approximately 5 feet (i.e., well screen from 27.5 to 32.2 feet below land surface) of continuous ECD response from 166MP001. This 5-foot length covers an ECD response range from the baseline to approximately 1.5E+06 microvolts. The analytical results from the samples collected from 166VP009 using the 6-inch well screen can be compared to 4 different 6-inch discrete ranges of ECD response.